Public Comment
GE/Housatonic River Site

Peer Review of
EPA's HHRA –
the Rest of the River

Sprout
– Berkshire Initiative for Children's Environmental Health
S. McNally MD, FAAP

1. Consistency with EPA's Policy

Protecting human health, safeguarding the natural environment

2. Exposure Scenarios

- **Volatilization**
- **Subsistence fishing/hunting**
- **Breast fed child**
- **Combined exposures – what happens when the angler is also a canoeist and also hunts?**

Low Birth Weight and Residential Proximity to PCB-Contaminated Waste Sites

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Previous investigations have shown that women exposed to polychlorinated biphenyls (PCBs) are at increased risk of giving birth to an infant with low birth weight (< 2,500 g), and that this relationship is stronger for male than for female infants. We have tested the hypothesis that residents in a zip code that contains a PCB hazardous waste site or abuts a body of water contaminated with PCBs are at increased risk of giving birth to a low-birth-weight baby. We used the birth registry of the New York State Vital Statistics to identify all births between 1994 and 2000 in New York State except for New York City. This registry provides information on the infant, mother, and father together with the zip code of the mother's residence. The 865 state Superfund sites, the 86 National Priority List sites, and the six Areas of Concern in New York were characterized regarding whether or not they contain PCBs as a major contaminant. We identified 187 zip codes containing or abutting PCB-contaminated sites, and these zip codes were the residences of 24.5% of the 945,077 births. The birth weight in the PCB zip codes was on average 21.6 g less than in other zip codes ($p < 0.001$). Because there are many other risk factors for low birth weight, we have adjusted for these using a logistic regression model for these confounders. After adjusting for sex of the infant, mother's age, race, weight, height, education, income, marital status, and smoking, there was still a statistically significant 6% increased risk of giving birth to a male infant of low birth weight. These observations support the hypothesis that living in a zip code near a PCB-contaminated site poses a risk of exposure and giving birth to an infant of low birth weight. *Key words:* birth registry, confounders, female, inhalation, male, very low birth weight. *Environ Health Perspect* 111:1352–1357 (2003). doi:10.1289/ehp.6053 available via *http://dx.doi.org/* [Online 18 March 2003]

for exposure. A statistically significant association between the mother's residence near hazardous waste sites and risk of having low-birth-weight births was found in some (Berry and Bove 1997; Elliott et al. 2001; Goldberg et al. 1995; Goldman et al. 1985; Vianna and Polan 1984) but not all studies (Baker et al. 1988; Kharazi et al. 1997; Shaw et al. 1992). Most of these studies did not consider the chemical composition of the waste within the sites. Because most waste sites contain multiple chemical components, it is usually not possible to determine which chemicals are responsible for the observed health effects.

A key to understanding which contaminant(s) might cause these effects comes from the observation that low birth weight occurs more commonly among women who consume large amounts of fish contaminated with organochlorine compounds, including polychlorinated biphenyls (PCBs), persistent pesticides, and dioxins/furans (Fein et al. 1984; Rylander et al. 1998, 2000; Vartiainen et al.

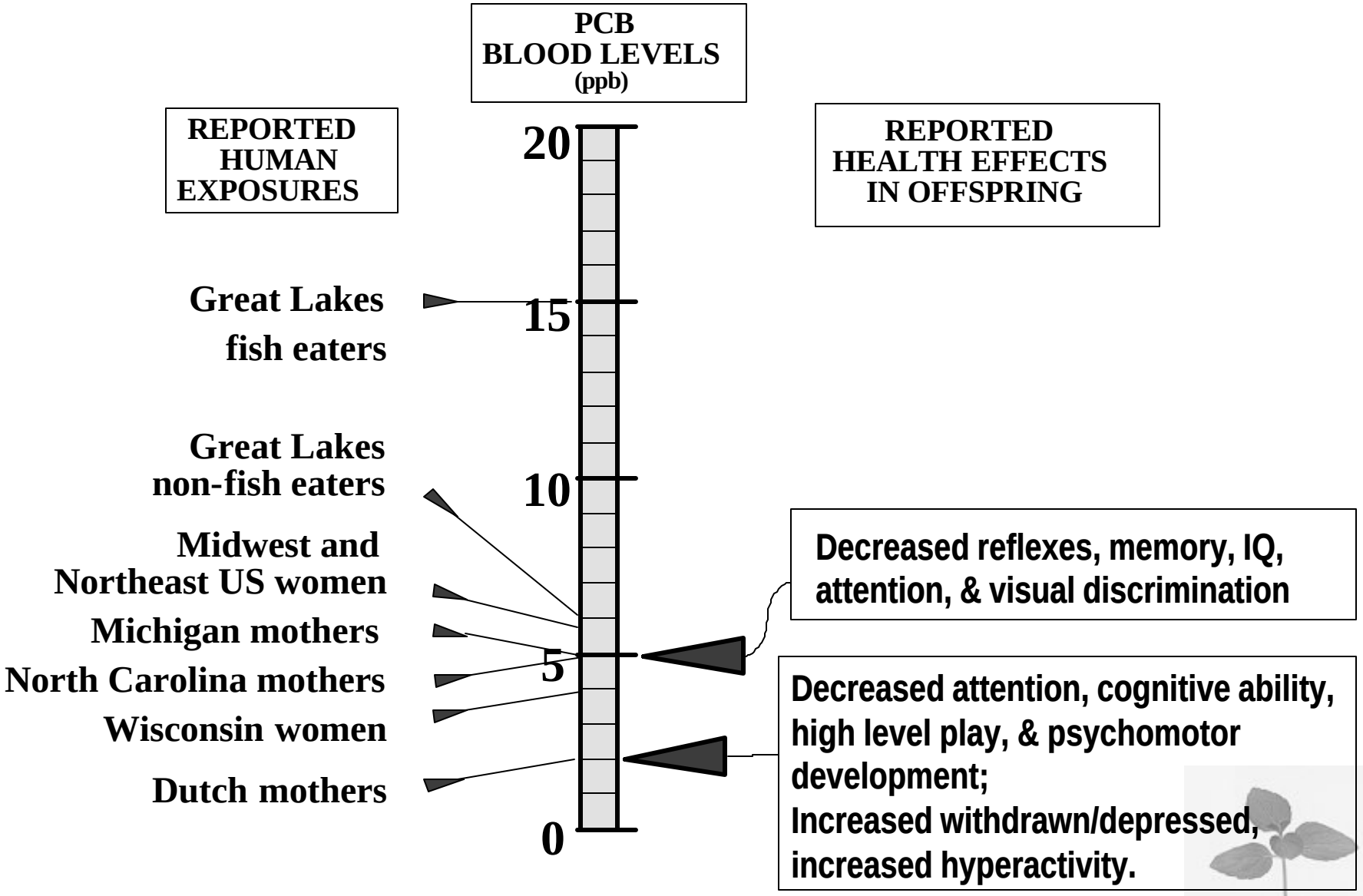
Subsistence Fishing/Hunting

Breastfeeding

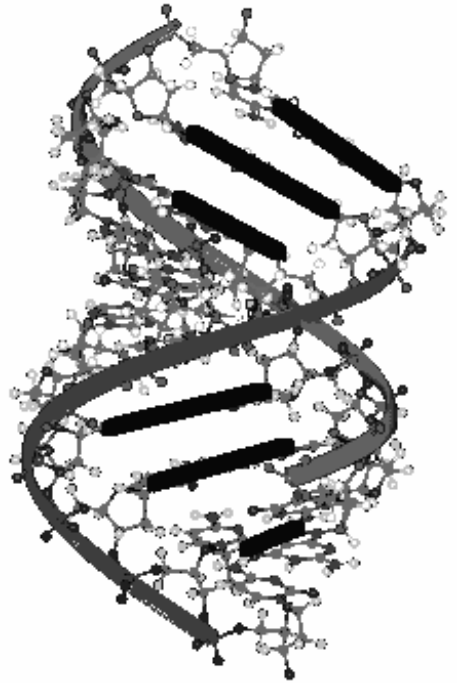
3. Toxicity Assessment

- **Toxicant**
- **Host susceptibility**
- **Timing of exposure**
- **Duration of exposure**

PCBs: Inadequate Margin of Safety

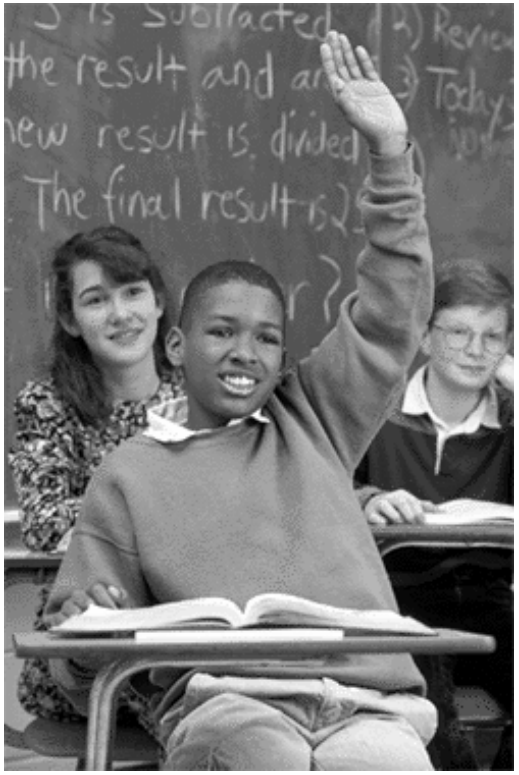


Genes load the “health risk” gun. Environment pulls the trigger.



Kenneth Olden, Director
National Institute of Environmental Health Sciences

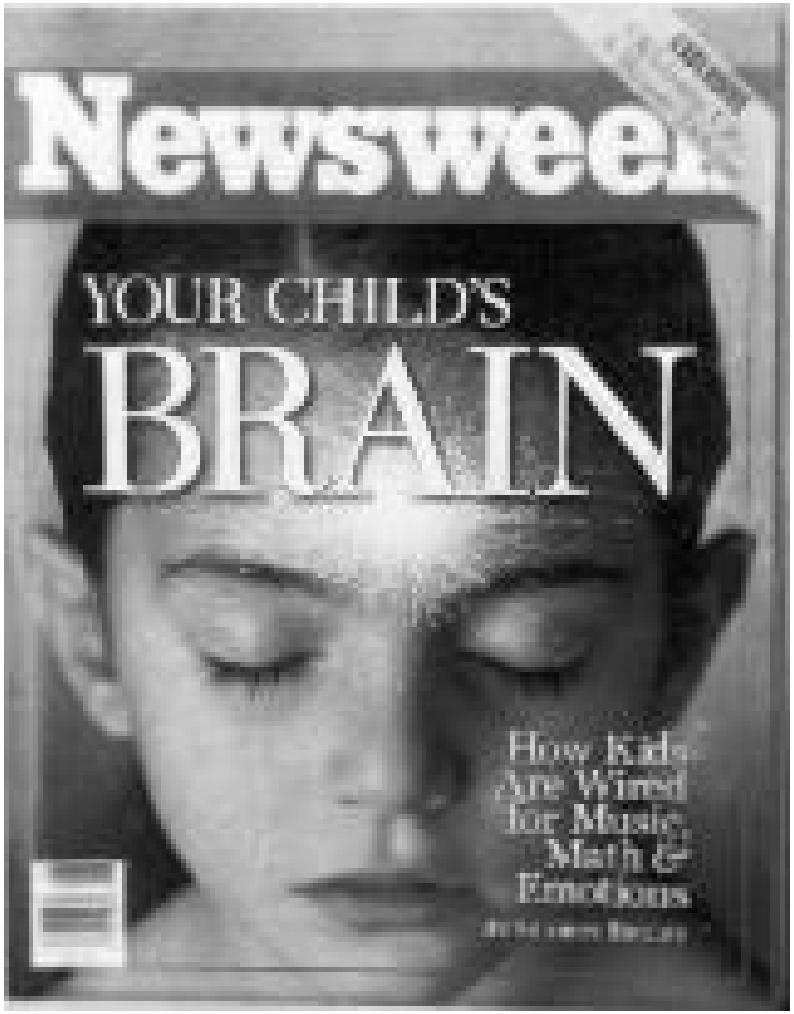
Unique vulnerability of children



Exploratory Behavior = Child’ s Work

- **Crawling, Toddling, Running**
- **Hand to Mouth Activity**
- **“Closer to the ground”**

Brain Growth and Development



- **some 100 billion neurons are formed during the first 5 months of gestation**
- **grows to 80% of adult size by 3 yrs of age.**

Prenatal PCB Exposure, the Corpus Callosum, and Response Inhibition

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The present study reports the association between prenatal exposure to polychlorinated biphenyls (PCBs), the corpus callosum, and response inhibition in children who are 4.5 years old. Children (n = 189) enrolled in the Oswego study were tested using a continuous performance test. We measured (square millimeters) the splenium of the corpus callosum, a pathway implicated in the regulation of response inhibition, using magnetic resonance imaging. Results indicated a dose-dependent association between cord blood PCBs and errors of commission. Splenium size but not other brain areas predicted errors of commission (r^2 = 0.20), with smaller size associated with more errors of commission. There was an interaction between splenium size and PCB exposure. The smaller the splenium, the larger the association between PCBs and errors of commission. If the association between PCBs and response inhibition is indeed causal, then children with suboptimal development of the splenium are particularly vulnerable to these effects. These data await replication. *Key words:* corpus callosum, impulsivity, inhibition, PCBs, polychlorinated biphenyls, splenium. *Environ Health Perspect* 111:1670–1677 (2003). doi:10.1289/ehp.6173 available via *http://dx.doi.org/* [Online 16 June 2003]

Response inhibition is a behavioral process characterized by active termination of prepotent, ongoing, or otherwise routinized behaviors (Barkley 1997). As such, response inhibition is crucial to the ongoing regulation of behavior—the ability to change behavior in response to changing environmental contingencies, to withhold or delay responding when appropriate, and to inhibit responses that are no longer relevant or adaptive in new contexts. Response inhibition is a key behavioral process for the successful completion of many tasks such as the continuous performance task (Losier et al. 1996), fixed-interval (FI) schedules of reinforcement (Darcheville et al. 1992; Rice 1997; Sagvolden et al. 1998), and delayed-response paradigms (Rice FI schedules of reinforcement (Cory-Slechta and Pokora 1991; Cory-Slechta et al. 2002), where low levels of lead cause rats to respond far in excess of the requirements of the reinforcement schedule. PCBs, a ubiquitous organochlorine contaminant in the environment, have also been associated with impaired response inhibition in rats in several studies (Berger 2001; Lilienthal et al. 1990). Possibly owing to differences in dosing and methodology, however, these results have not always been detected (Bushnell 2002; Holene et al. 1999). Most relevant to humans, however, is the work conducted with nonhuman primates, whose behavioral and physiologic characteristics are much closer to humans than are those of rats. Mele et al. (1986) showed that monreflects this process (i.e., errors of commission) (Grandjean et al. 2001; Jacobson et al. 1992).

Other major PCB cohort studies, including North Carolina, Dutch, and German cohorts, have not reported any investigations of response inhibition. Rather, these studies appear to have bypassed such domain-specific questions in favor of global cognitive tests and/or intelligence quotient (IQ) (Patandin et al. 1999; Rogan and Gladen 1992; Walkowiak et al. 2001). On the basis of all the above, it is clear that response inhibition is important yet, paradoxically, has received scant attention as an outcome measure in the human PCB literature. The present study was designed to address this deficiency. Children enrolled in the Oswego study were assessed using the Michigan Catch-the-Cat test, a variant of a continuous performance test (CPT), at 4.5 years old. The hypothesis being tested was that prenatal PCB exposure would impair response inhibition, specifically in the form of increased errors of commission. In addition, magnetic resonance imaging (MRI) scans were performed in the least exposed and most exposed children. The goal was to determine if any putative PCB-related deficits in response inhibition were associated with the morphometric changes in the posterior corpus callosum typically seen in disorders associated with impulse behavior, such as ADHD (Hynd et al. 1991; Semrud-Clikeman et al. 1994) and resistance to thyroid hormone (Hauser et al. 1997).

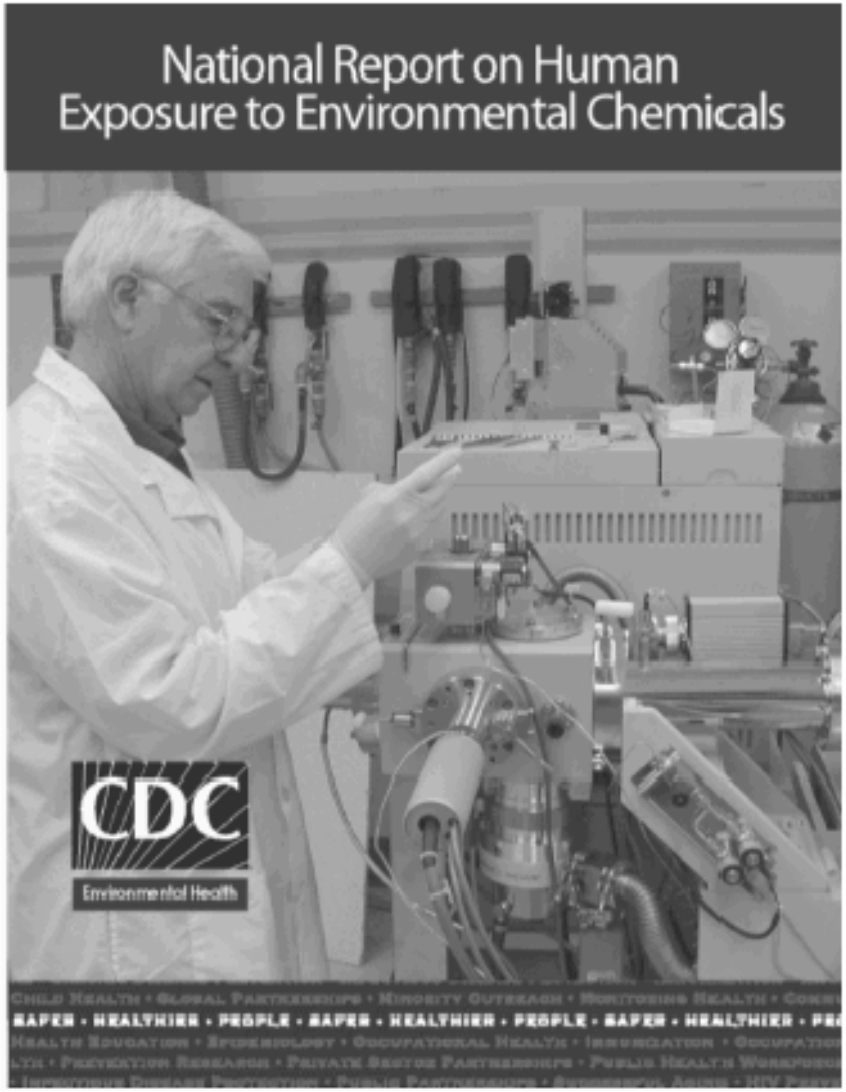
Longer “shelf life”

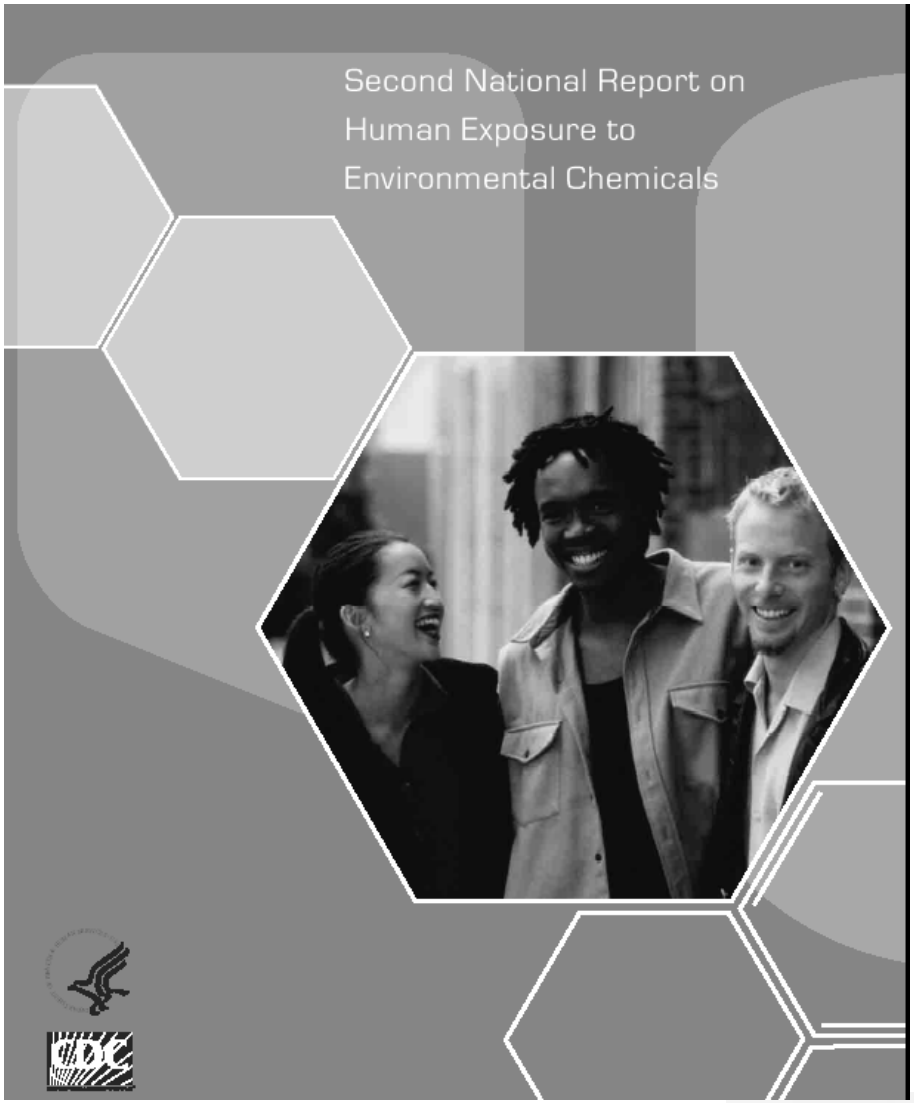
4. Risk calculations

PCB's/Dioxins

- **Persistent Organic Pollutants**
- **Bioaccumulate in Fat**
- **Degrade very slowly**
- **No Margin of safety**
- **Linked with Cancer, Endocrine Disruption, Neurodevelopmental Delays**

Pollutants without Borders





Background Exposure

MASSSTATS

Demographics | Education | Housing | Crime | Politics | **Health** | Other | Index

Choose a Map

Cancer Incidence

Cancer Incidence (All Types)

- >20% Below Expected
- 10-20% Below
- 5-10% Below
- 0-5% Below
- 0-5% Above
- 5-10% Above
- 10-20% Above
- >20% Above Expected
- N/A

1993-1997

MASSSTATS

Demographics | Education | Housing | Crime | Politics | **Health** | Other | Index

Choose a Map

Breast Cancer Incidence

Breast Cancer Incidence

- >20% Below Expected
- 10-20% Below
- 5-10% Below
- 0-5% Below
- 0-5% Above
- 5-10% Above
- 10-20% Above
- >20% Above Expected
- Insufficient Data

1993-1997

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5. Report Conclusions

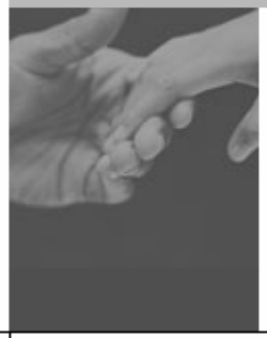
- **What is the public health message?**

THE NATIONAL CHILDREN'S STUDY

HEALTH GROWTH ENVIRONMENT

WHAT IS THE NATIONAL CHILDREN'S STUDY?

The National Children's Study will examine the effects of environmental influences on the health and development of more than 100,000 children across the United States, following them from before birth until age 21. The goal of the study is to improve the health and well-being of children.
for more information click here



Study News and Related Events

- National Children's Study Assembly Meeting, December 2003
- National Children's Study Advisory Committee Meeting, December 2003
- National Children's Study E-Update, August 2003
- Open Positions for National Children's Study

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GO

This study is led by a consortium of federal agency partners: the U.S. Department of Health and Human Services (including the National Institute of Child Health and Human Development [NICHD] and the National Institute of Environmental Health Sciences [NIEHS], two parts of the National Institutes of Health, and the Centers for Disease Control and Prevention [CDC]) and the U.S. Environmental Protection Agency (EPA).

The materials posted on this Web site support the deliberations of the National Children's Study Advisory Committee and come from a broad range of sources. As such, they do not necessarily represent the policies or opinions of the NICHD or its federal agency partners.

FIRSTGOV
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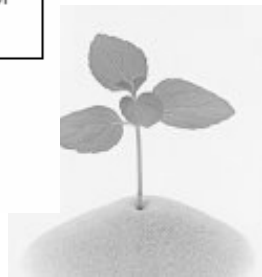

Precautionary Principle